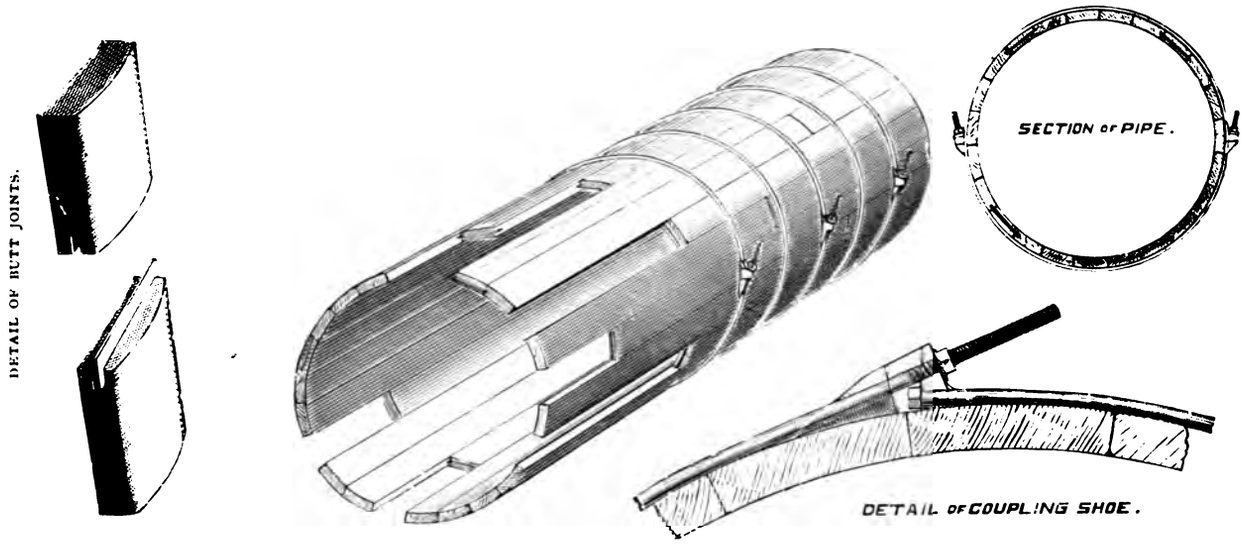
is likely to occur, as in the street pipes of a water-works distribution system, other pipe is to be preferred. But where the water pressure is steady and can be kept say, below eighty pounds to the square inch, as is usually the case with long pipe lines supplying city reservoirs, with irrigation siphons and portions of water power pipe lines, there is no pipe that is more economical and at the same time promises a longer life and does the work better than wooden stave pipe.

Steel and cast-iron are ordinarily considered more lasting materials than wood, for the reason that wood, as we see it used in common practice, is in a condition where it is alternately wet and dry. But once saturate the wood, and keep it saturated, and it will outlast any metal used in the constructive arts. It is not necessary to refer to ancient pile foundations (still sound and intact), or to logs buried scores of feet in swamps. More direct testimony



can be brought to bear from those using bored pipe, such as was laid — to the exclusion of all other pipe — over a hundred years ago. Such pipe was not capable of resisting heavy pressure, and in consequence has been generally abandoned. But where it has continued in use, and been kept full of water, it is as sound as when it was first put in. Can this be said of any metal pipe that has been in use but half that time? This much regarding the durability of the wooden stave.

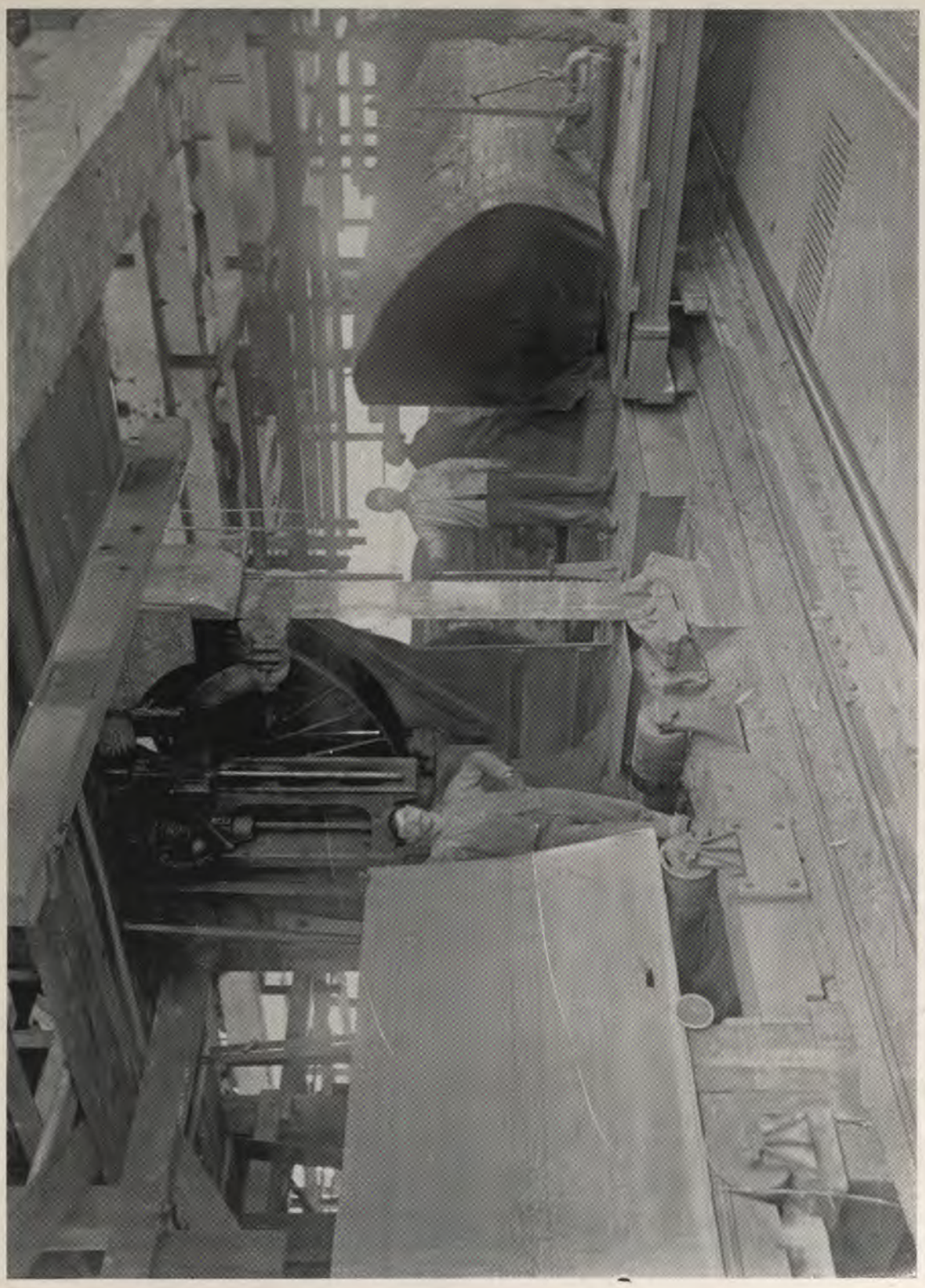
It will therefore be seen that the life of wooden stave pipe depends upon that of the steel bands which surround it. These bands, generally made of round steel from ⅜ to 1 inch in diameter, according to the size of the pipe, are coated with the utmost care before being placed upon the pipe, and are given an extra coating when they are in place. They are not touched by the water carried in the pipe, and corrosion can only take place through contact with the surrounding soil. They can generally be coated on the spot, with less danger of having the coating damaged in transportation by abrasion or cracking, than is possible with metal pipe. The steel is not spread out flat, as in riveted pipe, but is concentrated in round form. The percentage of rusting, which pits the metal of steel pipe and gradually renders it useless from leakage long before the strength of the metal is overtaxed, will cause no trouble whatever with wooden stave pipe. Leakage will only commence after the strength of the steel has been seriously impaired. This requires a lapse of time which experience has been too short to determine, even with the flat, and therefore less advantageous form of bands, and the less perfect coating, used fifty years ago.

As to how the wooden pipe does its work there can be no room for argument. Its interior is smoother than that of any other pressure pipe, for which reason it carries a greater amount of water. The difference is striking when both pipes are new, but it is far more so after years of use, when corrosion has imparted to iron or steel pipe a degree of roughness which seriously reduces its capacity, while wooden pipe remains perfectly smooth.

By the use of this pipe a wide and constantly growing market has been opened, as stated, for one of the main products of this coast, and at the same time it has been possible to carry out water works and irrigation propositions, the cost whereof would otherwise have been prohibitive. A double benefit has thus resulted by the use of wooden stave pipe, which will continue to grow as what remains of the unfounded prejudice against its adoption is being dissipated by experience and undisputable facts.

Among the principal pipe lines built of redwood may be mentioned the following:

Butte Water Co., Butte, Montana (domestic water supply); City of Logan, Utah (domestic water supply); Bear Valley Irrigation Co., Redlands, Cal. (irrigation); New Whatcom, Wash. (domestic water supply); Yakima Valley Canal Co., N. Yakima, Wash. (irrigation); City of Los Angeles, Cal. (irrigation); City of Astoria, Or. (domestic water supply); Montpelier, Idaho (water power); Mount Nebo Irrigation Co., Utah (irrigation); Hollister Water Co., Hollister, Cal. (domestic water supply); West Los Angeles Water Co., Los Angeles, Cal. (domestic water supply and irrigation); City of Kaslo, B. C. (domestic water supply); City of Denver, Col. (domestic water supply); City of Yuma, Col. (domestic water supply); and many others of minor importance.



THE BAND SAW AT WORK IN THE SCOTIA MILL.

On account of not being affected by the weather, and not shrinking, swelling, warping or twisting, redwood has no equal for car siding and roofing, where it is exposed to all sorts of weather—wet and cold, hot and dry climates, alternately.

Such, then, are some of the qualities and many uses to which redwood is pre-eminently adapted; and when its virtues have been properly tested, it has never yet been supplanted by any other wood in the lines for which its peculiar virtues recommend it. The constant increasing demand in countries where introduced speaks volumes in its praise. It is certainly very difficult to find any constructive wood in the whole realm of building material that for beauty and grandeur of growth, variety of grain, structure or color, or the number of purposes for which it can be used, will surpass the "*Sequoia sempervirens.*"

SHINGLE BOLTS AT J. G. LOVEREN'S SHINGLE MILL, EUREKA, CAL.

REDWOOD SHINGLES AND SIDING.

"Of all the woods converted into shingles," writes Mr. J. G. Loveren, a prominent shingle manufacturer of Eureka, Humboldt county, "Redwood is, beyond question, superior to any other in this country.

"Some advantages possessed exclusively by redwood, which are clearly due to the climatic characteristics of the Pacific Coast, are its enormous size, its comparative incombustibility, and its indisposition to swell, shrink or warp; its straightness of grain and its clearness in quality, the tree as a rule running about eighty per cent. clear timber. Redwood certainly will burn, but the acid with which it is plentifully impregnated enables it to resist the action of fire with great stubborness and success. Even after ignition a very little water is sufficient to extinguish the flames, and it is a remarkable fact that the City of Eureka, built entirely of redwood, never in its history had a destructive fire. For shingles, rustic, siding and every building purpose where exposure to fire is probable, the non-combustible quality of redwood renders it peculiarly adapted. Redwood walls compactly built are almost as indestructible as if made of

A FEW COMMON REDWOOD SHINGLES.

brick or iron. Fire makes little progress in a redwood forest. Such timber as spruce and pine a forest fire may, and in fact often does destroy, but the redwood escapes uninjured. Quite appropriate here is an extract from the columns of the *Northwestern Lumberman* on the lasting qualities of this wood. It says:

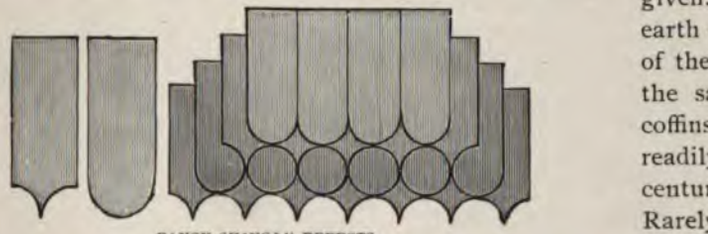
"'It is a beautiful lumber, wide and clear. It has a quality as distinct as the territory in which it grows. While not a veritable salamander, it is closely related to the salamander tribe. The district bounded by the fire limits of San Francisco is smaller than that of any other city of its size in the country; one reason being that the buildings are constructed largely of redwood and will not easily burn. If I may judge, this is a rare quality in any building wood, especially for residence purposes, yet so little is said about it that this information will undoubtedly be news to many. Redwood shingles are sold to a considerable extent east of California, but I have never heard of a lumber merchant using the argument, when trying to make a sale, that the shingles will not readily burn. He says that redwood is a well-made, clear, durable shingle, and of a pretty color. Ten to one, if you are in a gambling mood, he knows of no other taking adjective to apply to it. The shingle is all that and more. Why does not the dealer say: 'I want to sell you this shingle, for I believe you are a man of too much sense to desire that you or your family be incinerated. Cover your house with this material, and when the dwellings and barns of your neighbors burn the sparks will not set fire to your roof.' That certainly would be a convincing argument, but it is not made use of.'

"The fact that redwood swells or shrinks or warps but slightly specially adapts it not only for shingles but for tanks, vats and patterns, while its rich color and susceptibility to high polish, especially of the curly-grained varieties and huge bird's-eye burls, are bringing it into great demand for cabinet work. To such of our eastern compatriots as stand in awe of the *Cimex lectularius*, it may be reassuring to know that this pestilential insect never invades a redwood house or a redwood bed. The marine teredo, which destroys all wood alike, is the only insect that has ever been known to attack redwood timber.

A "SKID" ROAD.

"The endurance of redwood and its resistance of decay are qualities which make it superior to other woods for various purposes. In the outskirts of Eureka stands old Fort Humboldt, where in 1853-54 General Grant was stationed. The shingles were laid on the building in 1852, and yet to-day, after forty years' exposure to the storms of the ocean and the land, they are still sound and useful. In such a condition are they, in fact, as to excite the wonder of all not familiar with the qualities of our timber. A more forcible illustration of the comparative indestructibility of the California wood could not easily be given. It is little affected by time or by contact with earth or water. Especially is this true of the lower half of the redwood trunk, which appears to contain most of the sap. Its value for sills, posts, ties, stakes, piles, coffins and foundation-timbers, could not, therefore, be readily exaggerated. The stumps of trees felled half a century ago are mostly as sound to-day as they ever were. Rarely does a redwood stump show signs of decay.

"One of the faults found with the building woods of the Eastern and New England states is their inability to 'hold paint.' That is, the wood refuses to absorb the oil properly, with the result that the paint peels or scales off after a time. Whenever it has been sought to introduce redwood in these States, one of the first questions asked has been: 'Will redwood hold



FANCY SHINGLE EFFECTS.

SOME FANCY REDWOOD SHINGLES.

THE HOME

OF THE

REDWOOD

A SOUVENIR

OF THE

Lumber Industry of California

REDWOOD

WHERE IT GROWS

ITS MANUFACTURE INTO LUMBER

ITS ADAPTATION FOR ALL GENERAL USES

ITS VARIOUS USES

ITS LASTING QUALITIES

PACIFIC COAST WOOD AND IRON
S. L. EVERETT, Publisher
San Francisco
1897

A LIVING TESTIMONIAL

WHAT might be called "natural examples" of the endurance of redwood are found throughout the forests of the redwood belt, in fallen trees that have lain for hundreds of years, and are still sound. On the redwood property of McKay & Co., near Eureka, Humboldt county, was found an instance that was so remarkable and conclusive that the camera was called in to perpetuate the evidence. Here is a fallen redwood tree, 6 feet in diameter, lying half buried, but as solid and sound as when blown down by some tornado years and years ago. The remoteness of this catastrophe is attested by a "living witness" in the shape of a spruce tree, 30 inches in diameter, and certainly 100 years old. This tree has grown on top of the fallen redwood, its roots dividing and extending down on each side of the prostrate giant, holding it in a living embrace as it were.

ANNOUNCEMENT.

IN THE following pages it has been the aim of the Association to present in an entertaining manner the story of California's famous timber, the *Sequoia* or Redwood, a timber whose many points of excellence for industrial purposes are unfortunately too little known. The points of the story were gathered in "The Home of the Redwood" itself, and in its telling, in no instance have the facts been sacrificed with poetic license. Rather have they been subdued, for fear of a charge of exaggeration, but where the pen has failed to do them justice, they may be seen reflected from that truthful mirror of nature, the camera.

In the preparation of the work, the Association is indebted to Mr. Geo. D. Gray, their Manager, for his story of the Redwood and the methods employed in the manufacture of its products; to Mr. E. C. Williams for his faithful description of the resources of Mendocino County; also to the Humboldt Chamber of Commerce for a number of the illustrations.

A. A. CURTIS,
J. J. LOGGIE,
JAMES DOLLAR,
MILES STANDISH,
Committee on Publication.

THE HOME OF THE REDWOOD.

AT THE beginning we would state that the object of this book, issued under the direction of the Redwood Lumber Manufacturers of California, is to introduce to the lumber dealers and wood workers of the world that unique product of the forest which is found now only on the shores of the Pacific Ocean and in the State of California, U. S. A., and called by the botanist *Sequoia sempervirens*, and by the lumber and timber dealers "Redwood."

It would seem that it should not be introduced as a "new" wood, because it belongs to a class that is one of the oldest of our forest trees; in fact the *Sequoia* belongs to a flora of a former era, as is evident from specimens that have been found among the fossils of the Cretaceous Period in Norway, Sweden and Spitzbergen, in the Eastern Continent, and in Alaska, Wyoming and Colorado of the Western.

The only living representatives of what was a very extensive family are now to be found in California, with possibly a few specimens of what may be called distant relations in Japan and in one of the southern States of the United States, and it is quite possible that the claims of all those outside of California would be rejected should their title to the genus *Sequoia* be closely investigated. Of those representatives in California, the *Sequoia gigantea* are located in the interior of the State, on the western slope of the Sierra Nevada range, and to the east of the great San Joaquin Valley. It was probably when this great valley was one vast inland sea, whose fogs and moisture were precipitated upon the fresh moraines left by the receding glaciers, that the *Sequoia gigantea*, or "Big Trees," of California first sprang from the ground, and now some of them, centuries old, tower 300 to 400 feet in height, the largest of them being 30 to 40 feet in diameter.

But the redwood of commerce is the *Sequoia sempervirens*. It is to this branch of the family that the term "Redwood" properly belongs, in the forests of which has developed one of the most important industries in the State of California, and of which this pamphlet is particularly intended to treat, and whose characteristics and virtues it is intended to lay before the public.

The extent of country to which the *Sequoia sempervirens* is confined is about 300 miles long and about 20 miles wide, lying on the coast of the State of California, between the 37th and 42d parallels of north latitude, or from Monterey bay on the south to the northern boundary of the State.

But within these limits not one-half the area is covered with redwood forests, the balance being open country devoted to farming and dairying purposes, sheep and cattle ranges, or covered with oak, pine, fir and other trees.

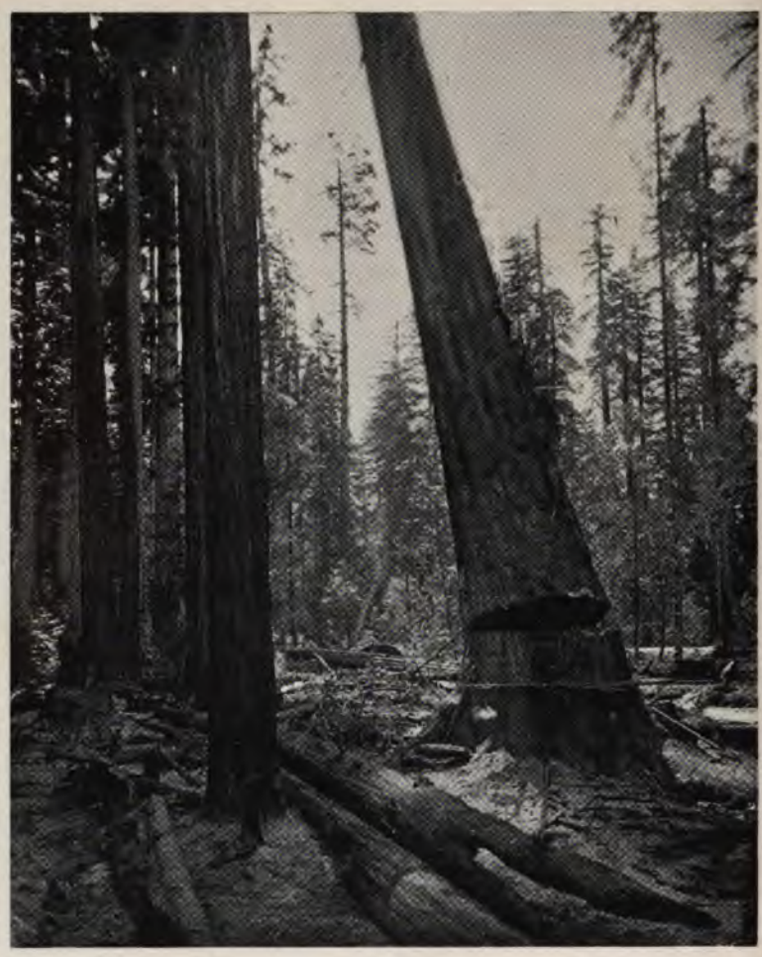
A MONARCH OF THE FOREST.

Through all this country the rains are heavy in winter and the fogs dense in summer, coming in regularly every day during the warm season. During the winter months snow never falls in the southern part of this belt, and rarely in the northern part, except at the higher elevations, and there to remain for only a day or two. The

the whole mass in one body and sent it whirling and swirling in a mad chaos to the valleys below.

Sometimes where the amount of water was small dams were built that impounded an immense amount of water, then the gates were opened, and the sudden rush of water swept the logs down, to be caught again at the mill located in the valley below.

While some of the mills still depend upon water for their supplies of logs, the most of them are equipped with railroads, locomotives and cars. These roads extend from the ponds and the mills into the logging camps, but beyond these, away up the ravines and hillsides, are built logging roads, over which the logs must be hauled to the cars. For handling these monsters no ordinary road will answer. It must be wide and smooth as a turnpike; all rocks and roots must be carefully removed, all hollows and gullies filled up. If the ground is level or soft, skids or cross-logs must be laid down to prevent the logs from digging into the earth as they are being hauled along, for no wheeled vehicle of any kind is used in transporting the logs in the woods; they are simply "snaked" along over the ground. To reduce the friction water is used where the road-bed is earth and oil or "skid-grease" where it is skidded. It is the "skid-greaser's" business to go over the road and apply the lubricant wherever needed before each team, with its train of logs, comes along. The water is carried in bags on horses and emptied into tubs alongside the road where needed.



FALLING.

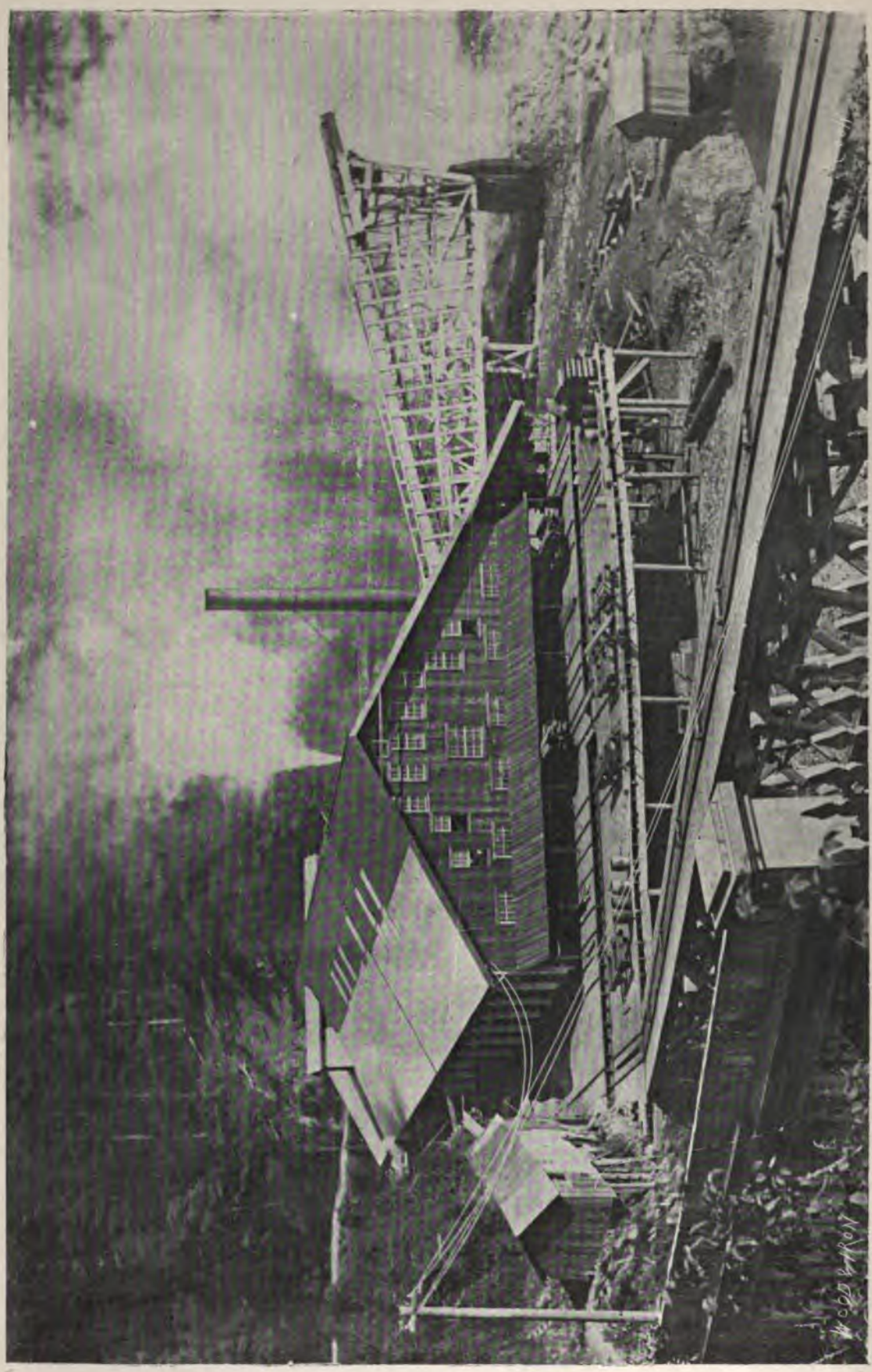
With the road built, then follows the task of rolling the logs into it. For this purpose a portable steam engine is now generally used. The machine is known as "Dolbeer's Steam Logging Machine." It consists of an upright boiler and engine, somewhat similar to a portable hoisting engine, except that instead of a reel to wind the rope on, it has a "gypsy head," similar to a capstan on board a ship. It is placed on a strong frame, the sides of which are like sled runners. To move the machine around in the woods, a line is run ahead and made fast to a tree or stump, then two or three turns are taken round the "gypsy," the engine is started up, and the "gypsy" winding in the rope, the machine hauls itself in any direction wanted. When in place it is made fast to a tree or stump, and a line run to the log that is to be removed, and by means of snatch blocks, it is hauled in any direction desired. As the machine has about twenty-five horse-power, the work can be done much cheaper and quicker than by oxen or horses. Once in the road, the cattle are needed. Several logs are fastened together

FALLEN.

to make a "train," and hauled to the railroad to be loaded on the cars, or to the stream to be floated to the mill. To handle a team of eight or ten yoke of oxen in front of a train of logs, requires a teamster of more than ordinary ability. The best teamsters command a salary of $150 to $180 per month. The "train" once started, there must be no stopping if it can be avoided. It is a great sight to look at one of these "trains" started up and moving. Here are ten yoke of sturdy oxen, and behind them the "train" of ten to fifteen great logs, of all sizes from four to ten feet in diameter, fastened with strong "dogs" and chains, one behind the other. All is ready. At first, the driver walks up and down the length of his team, speaking softly to this or that one by name, and gently spurring up the lazy ones with his stick, until he sees that every animal is bearing equally on the yoke. Now for it! He shouts and yells, curses and swears, calls every animal by name, and consigns every individual one—hoof, horns, and hide—to all the torments mentioned in Dante's "Inferno"—shouts again, and wishes he was skilled in six languages, that he might give more variety to his vituperations, while amid the din and uproar every beast strains himself to the utmost. See, it moves!

Alongside, up and down the long line of logs, hastens the "water packer," filling his pail from barrels of water standing on the roadside, dashing some of it under this or that log to reduce the friction. Over this level ground, once started, it runs smoothly, but now they come to a steep pitch in the road, the logs begin to slide, and faster and faster as each new log comes to the top of the incline and begins its descent; but the driver is on the alert, and at a signal from him the whole team breaks into a wild run. It is a grand sight, twenty huge oxen tearing down hill, while just behind them come ten to fifteen great logs thundering after. It is a run for life or death. Should the leaders lag it means death to those behind; should an animal stumble and fall it may be the cause of killing half the team. Away they go, and for a few moments it seems a question whether team or train will reach the level ground first; but the road is well built and the driver has his team well in hand, and now at the bottom of the steep pitch they gradually "slow up," they lean against their yokes, and so they go, until

FELLED TIMBER NEAR SCOTIA, HUMBOLDT COUNTY.



CASPAR MILL.

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FELLED TIMBER NEAR SCOTIA, HUMBOLDT COUNTY.

the logs are safely landed at the railroad or the river. The loads sometimes hauled by these ox-teams are enormous. A train of seven logs hauled in Humboldt county in 1878 by A. A. Marks, teamster, scaled collectively 22,500 feet, board measure, of merchantable timber.

THE BUTT CUT.

The introduction of the portable donkey engine, or steam logging machine previously referred to, however, has rung the change on this crude, costly and dangerous method. The superiority of the steam logger, as compared with the "bull" teams, for gathering the logs into the main roadway, thence to be hauled away by oxen or horses, suggested another improvement in the method—that of doing away with animals altogether. This suggestion has been carried out, with the result that from nearly all of the logging woods of the redwood belt the ox and horse have disappeared, and in their places are puffing and snorting steam engines,—the steam logger at one end of the roadway, gathering the logs from the hillsides to be made into "trains," and at the other end, another, but larger steam winding machine, for hauling these trains to it by means of a stout steel cable.

This last mentioned machine is called the "Bull Donkey," and first made its appearance among logging appliances in 1892. It is essentially a huge and powerful donkey engine, having two large drums—one with a capacity for carrying two or three miles of 1-inch steel wire cable, and the other with a capacity for winding double that amount of smaller cable. This machine is stationed at the end of the road nearest the end of the railroad, and at the beginning of operations the lighter cable is carried back to the neighborhood of the steam logger in the woods where it is rove through a fixed block and thence back to the machine and attached to the end of the heavier cable. By this means an endless cable is formed and the heavier cable is hauled into the woods, a mile or more, to be attached to the "train" awaiting it. This done, and all being ready, electricity conveys a signal to the machine at the other end of the road, which then commences to wind in this great length of cable, dragging to it a dozen or more logs at a greater speed than ever cattle hauled them.

Once delivered at the "landing" alongside the railroad track, the process of loading the immense logs upon the cars is quite interesting. Owing to their great weight and size, their handling requires considerable skill as well

AT THE OTHER END.

as power. The loading is usually done by means of jack-screws, or lifting jacks; the log being rolled over and over and on to the car, where it is secured with chains and wedges or chocks.

From the "landing" to the mill or tide-water by train, little of interest presents itself, unless it is the opportunity to judge of the size of the logs as compared with the locomotive, and also of the length of the trains. The journey is usually short, and arrived at the mills the logs are dumped into a pond for storage until needed.

The logging season in California is the reverse of what it is in the eastern part of the United States or in the north of Europe. In these latter localities the trees are felled, and most of the logging is done when there is snow on the ground, but in California where there is no snow but very heavy rains in winter this is impracticable. The ground is too soft and slippery. The handling of these heavy logs would be dangerous and difficult. Therefore most of the logging is done in the summer season, the logs being stored in ponds until needed.

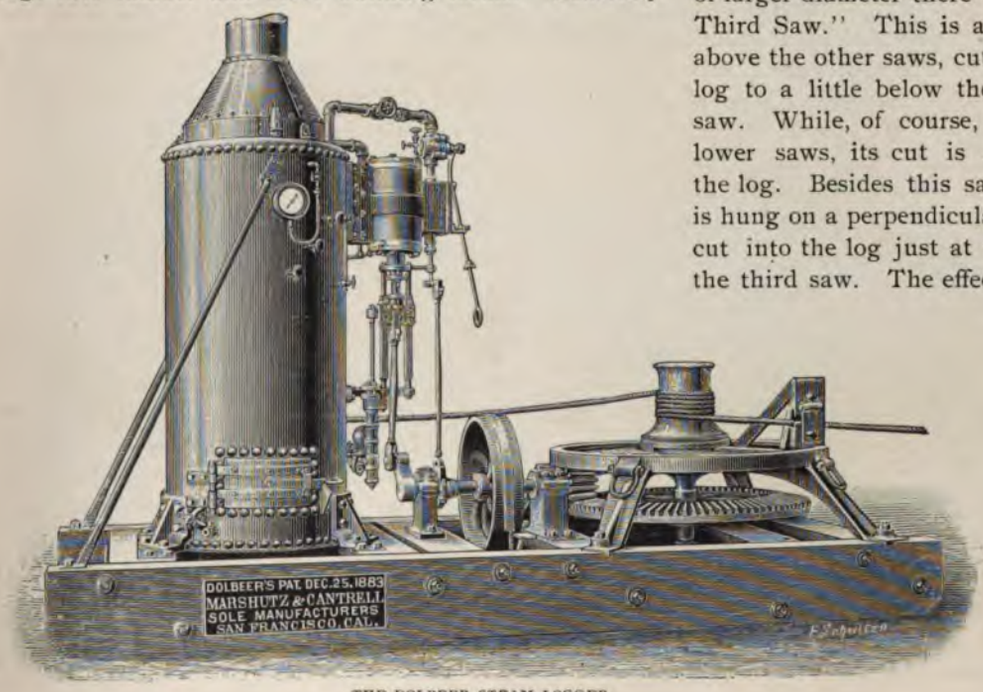
LOGS.

MAKING THE LUMBER.

It would be quite difficult to describe all of the many machines and methods for manufacturing the redwood logs into lumber and other building forms. Generally the machinery is similar to that used in manufacturing other lumber except that, on account of the size of the logs handled, it must necessarily be stronger and heavier.

The redwood mills are generally up to the times, and are quite ready to adopt all the latest improvements in saws, edgers, trimmers and planers. The saws are invariably double circulars or band saws. Sometimes both are used in the same mill. The circular saws are usually about sixty to sixty-four inches in diameter, and are hung one above the other; one cutting from the bottom of the log and the other from the top, the saw kerfs meeting in the center of the log, thus enabling the mill to cut plank four and one-half to five feet in width. But for logs of larger diameter there is used what is called "Evans' Third Saw." This is a saw hung on a horizontal shaft above the other saws, cutting down from the top of the log to a little below the arbor or shaft of the middle saw. While, of course, its kerf is kept parallel to the lower saws, its cut is made four inches further into the log. Besides this saw there is a fourth saw, which is hung on a perpendicular arbor, and makes a horizontal cut into the log just at the bottom of the cut made by the third saw. The effect of running these two saws is to rabbet out a piece extending from the top of the log to a little below the collar of the middle saw. Mills thus arranged can, by "turning down," saw logs eight feet in diameter, but logs of larger size must be split.

Until the last few years, double circulars were generally used in the redwood mills, but the band saw is rapidly



THE DOLBEER STEAM LOGGER.

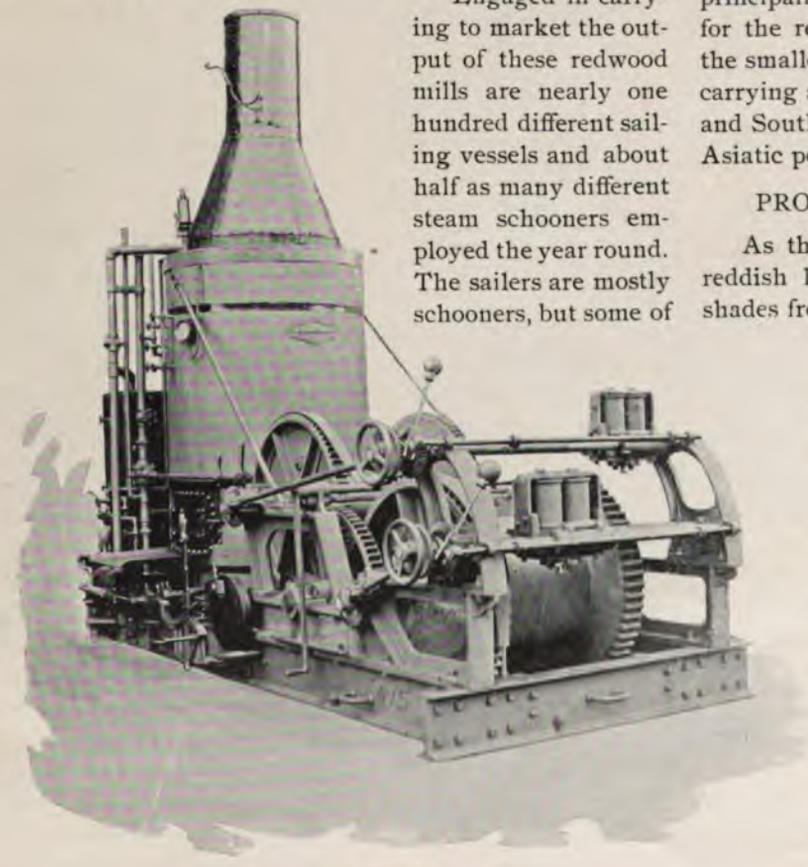
supplanting them, and all along the coast it is doing its heavy work to great advantage. The indications are that it has come to stay in the redwood mills. It cuts its way through the mighty giants and lands at the tail of the mill the lumber in perfect condition.

STEAM LOGGER AT WORK.

SHIPPING THE LUMBER.

All of the lumber from Mendocino, Humboldt and Del Norte is brought to San Francisco and other ports by water. In the last few years steam schooners with a carrying capacity of fully 400,000 feet have been built, and have almost entirely driven from the trade the sailing craft. One of these little vessels will steam up to what is almost an inaccessible bluff. A wire rope is thrown out to and over her and soon car loads of lumber are being sent in cradles to the deck of the vessel. Oftentimes while loading severe storms arise and the wires are let go and the vessel puts to sea to outride the storm, when it returns and the business of loading is resumed. One of the most picturesque loading places is at Greenwood, a fine view of which is presented on page 17, the "steam schooner" being seen with the wire chute connecting it with the rocky promontory where the lumber has been taken by cars.

Engaged in carrying to market the output of these redwood mills are nearly one hundred different sailing vessels and about half as many different steam schooners employed the year round. The sailers are mostly schooners, but some of them are unusually large for that rig of vessel, many having a tonnage of 600 and over. The larger craft are generally three, four and five-masted and are employed in the direct trade with Central and South America, the islands of the Pacific, and Australia. The smaller vessels, which range from 100 to 300 tons burthen, and the steam schooners, are used in the trade with coast ports, principally San Francisco, which is virtually the depot for the redwood mills. Here, too, numerous cargoes of the smaller vessels are transferred to large sailing ships carrying a million feet or more, for shipment to England and South Africa on the Atlantic side, and Australia and Asiatic ports on the Pacific.

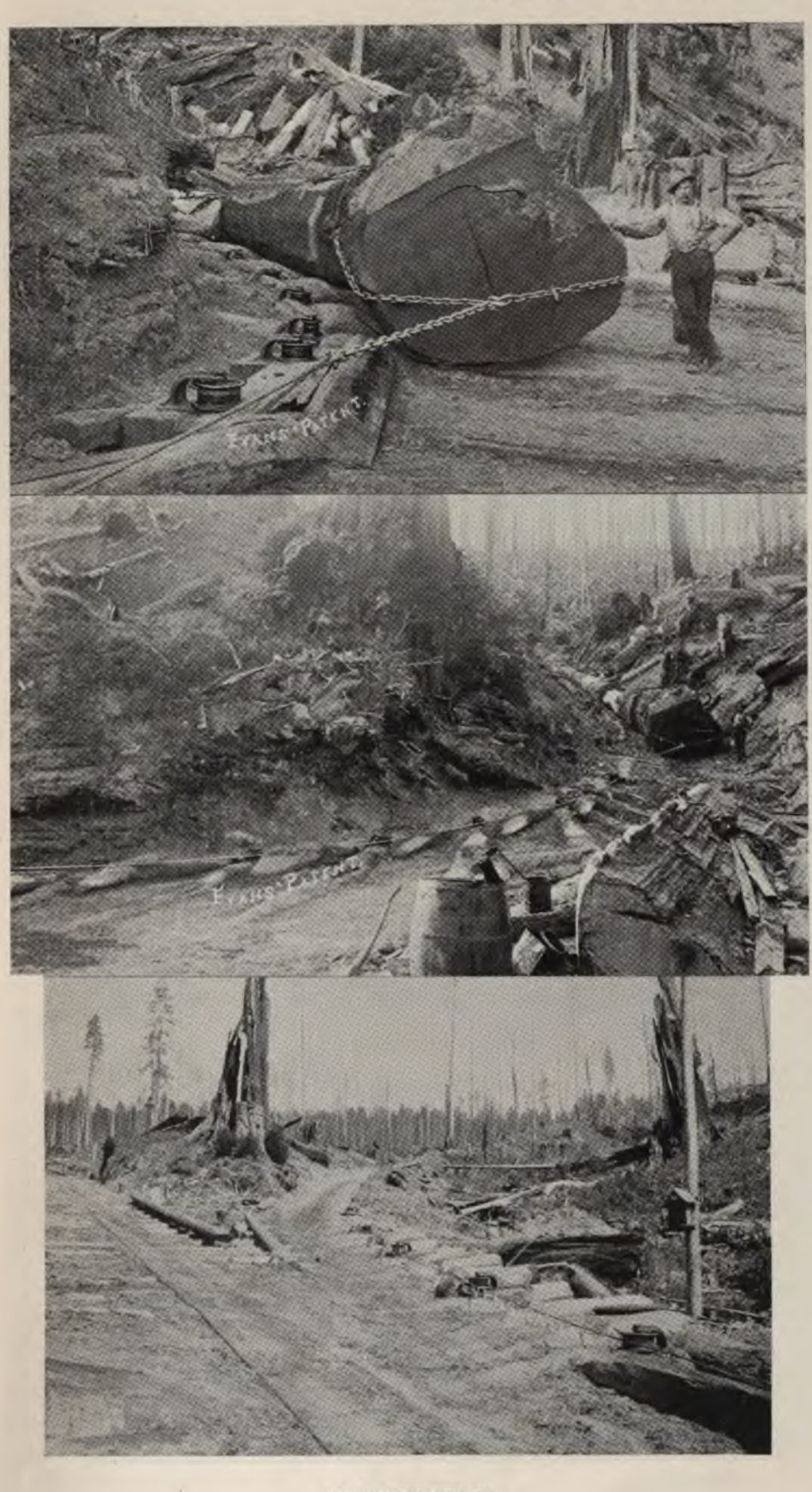


THE "BULL DONKEY."

PROPERTIES AND USES OF REDWOOD.

As the name indicates, the color of the wood is of a reddish hue; but there is considerable variety in the shades from a light cherry to a dark mahogany. Timber grown upon the rich loam of the bottom lands will generally run to the darker hues, while in that from the lighter soil of the hillsides the lighter shades prevail, some of which bear a strong resemblance to Spanish cedar.

In general the grain of the wood is very straight, so that it is not difficult to split out a plank two inches thick, twelve inches wide and twelve feet long—but trees can also be found that vie with French walnut in the beauty and variety of their curves and figures in the grain. This difference in shade and figure enables the house-builder, by proper selection, to secure many surprisingly beautiful effects where the natural unpainted wood is used for interior decoration. Where it is desired to preserve the natural color of the



CABLE LOGGING ROAD.

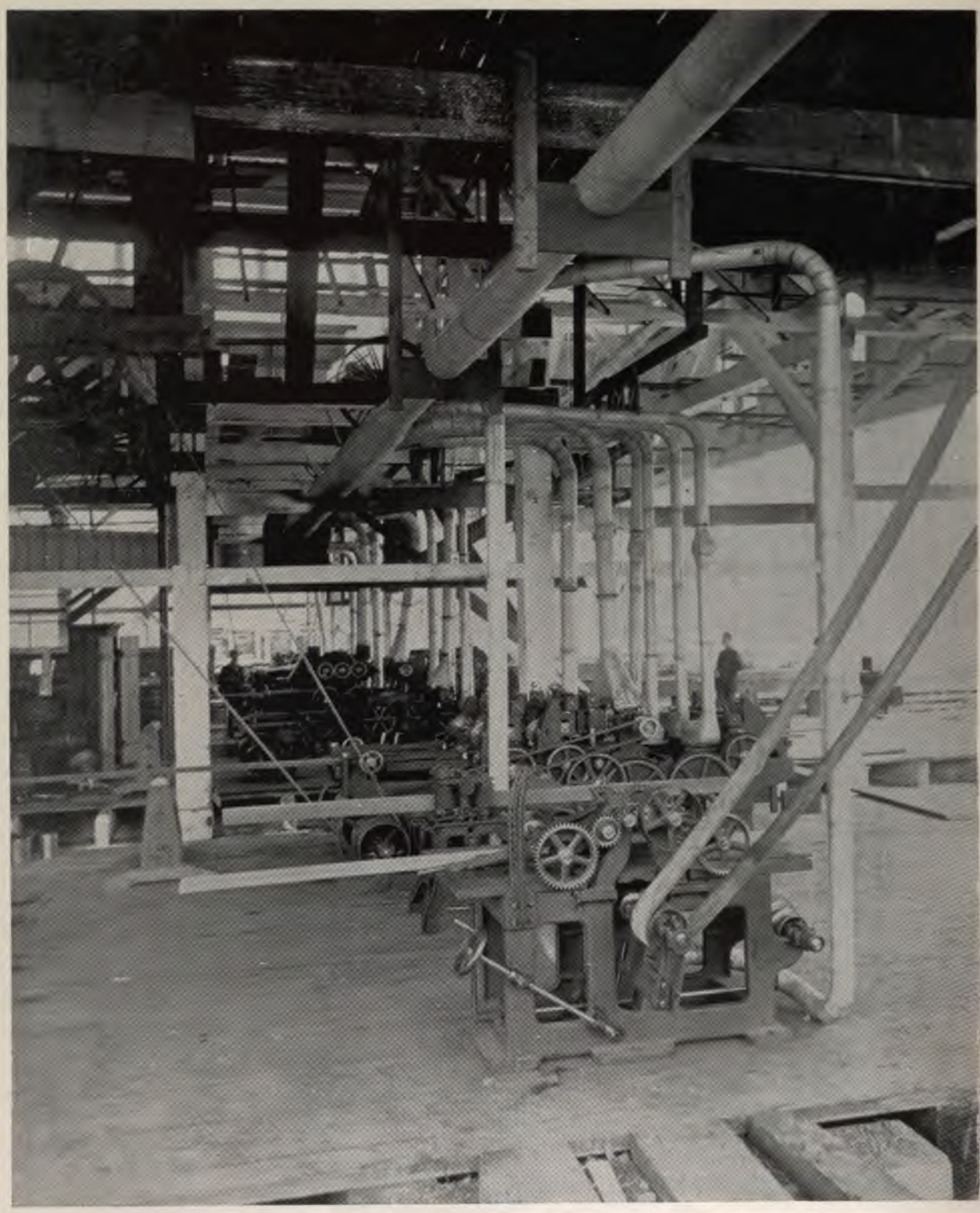
wood, the use of oil should be avoided in finishing because it causes the lumber to turn dark.

When once finished there is no material which changes so little and retains its gloss and beauty better than redwood. Nor is there any material which forms a better basis for staining and graining in imitation of other dark woods. It is largely used for coffins, for which it is sawed in a special way so that the grain is vertical. When this has been prepared, grained and polished in a proper manner, he must be little less than an expert who is not deceived into believing it genuine rosewood or mahogany.

But while the figured wood is choice, and in many places desirable, there is comparatively little of it. The grain in most of the wood is very straight, and the material is soft and easily worked into carvings, mouldings and brackets of any desired shape and size; the evenness and regularity of the texture cause it to be particularly adapted for turned and carved workings.

Another peculiar character of the wood is that there is very little shrinkage in drying, and when once seasoned it is not at all affected by the changes of climate. On this account it is in demand for patterns and models for castings, for panels and styles for doors, particularly outside doors that are exposed to changes of rain and sunshine.

For furniture, such as mantels, sideboards, desks, counters, fancy table tops, book-cases, interior finish of cars, fine paneled bedsteads and all kinds of massive furniture, newel-posts, banisters, grille work, ornamental brackets, etc., no wood is so easily worked, or will remain so perfectly or securely in place without shrinking or swelling as redwood.



INTERIOR OF PACIFIC LUMBER CO.'S MILL.

HUMBOLDT COUNTY

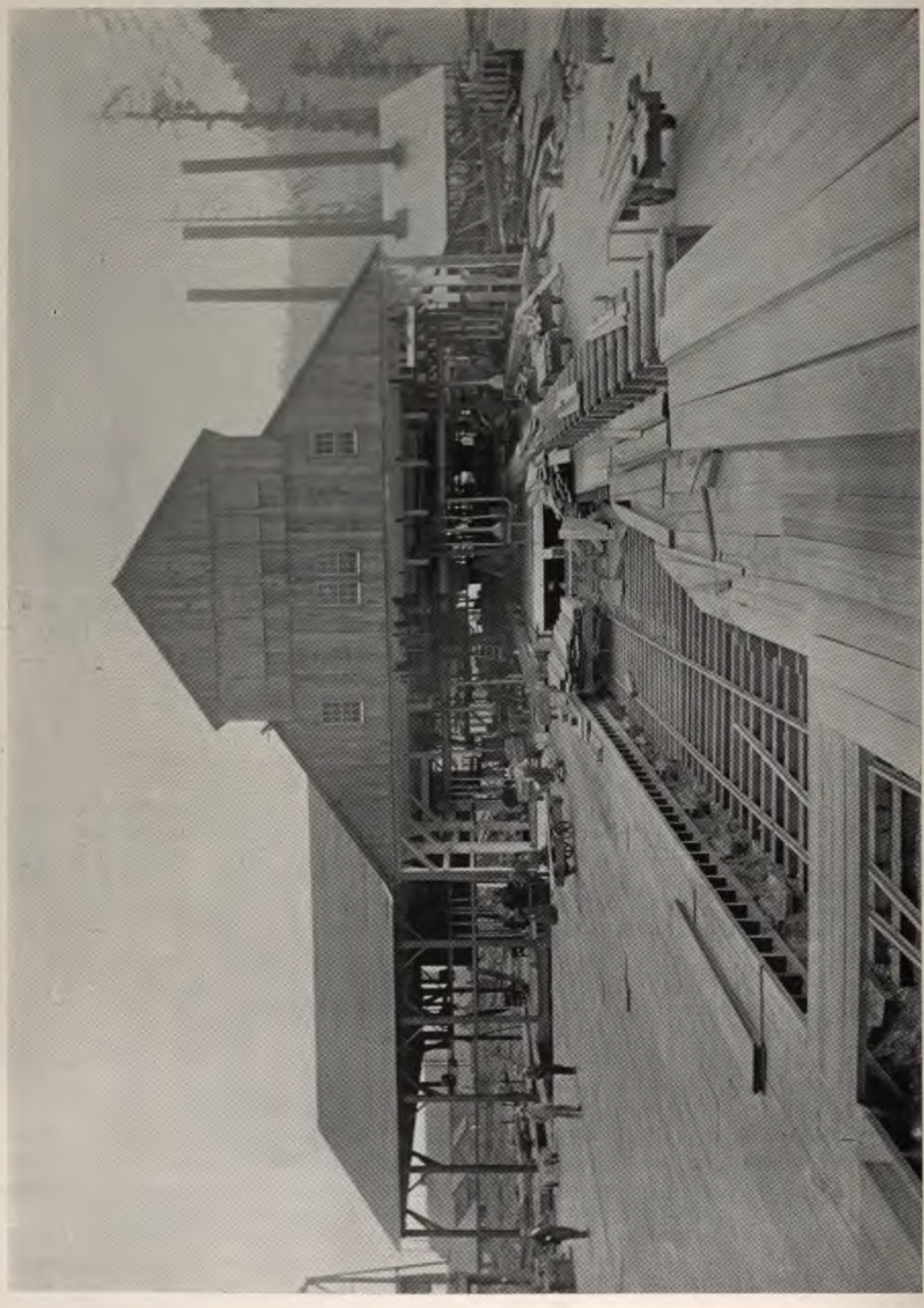
HER FORESTS AND MILLS

HUMBOLDT county, lying between her sisters of the redwood belt — Del Norte county on the north and Mendocino county on the south — has within her borders the heart of this unique and magnificent forest, which extends along the coast of California through six degrees of latitude, or from Monterey county on the south to the Oregon line on the north. This fact, together with her many developed resources and the possession of one of the finest harbors on the Pacific coast — Humboldt bay, the only land-locked harbor in the State north of San Francisco — justly entitles her to some distinction among her sisters.

Humboldt is the largest of the northern coast counties of California, having an extreme length of one hundred and eight miles along the coast, and an average width of about forty miles. In topography, and the general appearance of her coast line, she greatly resembles her sisters to the north and south. Numerous streams, discharging into the ocean, drain her fertile valleys, the most important of which, named in their geographical order, are Mattole river on the south, Bear, Eel, Elk, Mad and Little rivers, Redwood creek and Klamath river on the north. All of these streams flow in a northwesterly direction, and this general course marks the trend of the hill and mountain ranges, which rise, one behind the other, from the shore inland. Eel river, with its source in Mendocino, and draining the famous Eel river valley, is the principal stream. It enters the county with the redwood belt, at about the center of the southern boundary, and with a total length in Humboldt of about seventy-five miles, forms the natural drain for the redwood region to within twelve miles of its mouth. For miles and miles its banks are covered with almost impenetrable forest, as are also those of its main tributary, the Van Duzen river, which comes in from the eastward. Mad river, however, which crosses the county about twenty-five miles farther north, while not as important a stream, is perhaps the most celebrated, for on its banks, and those of its tributaries, are found the finest bodies of redwood timber in the entire belt.

As in Mendocino, the redwood forests extend throughout the length of the county in a comparatively narrow strip, but do not appear on the coast except in the northern half, as they follow Eel river up through the central part in the southern half. The average width of the strip in Humboldt, however, is less than in Mendocino, which gives Humboldt a somewhat smaller acreage of redwood forest, but this deficiency in area is more than compensated for by a heavier growth, with a larger percentage of clear timber, the yield of lumber per acre being therefore greater and more valuable. It is estimated that of Humboldt's entire land area of 2,224,000 acres, her forests originally covered nearly 1,000,000 acres, of which 538,000 acres were redwood, 320,000 acres were pine, spruce and fir, and the balance oak, laurel, madrone, etc., and that, although lumbering operations have been carried on since 1851, the area still remaining is over 930,000 acres. Of the redwood area remaining in Humboldt, careful computation fixes it at about 492,000 acres, which represents a supply that will take two hundred years to exhaust at the present rate of cutting.

The development of the timber resources of Humboldt commenced with the first settlement of the county, on Humboldt bay, in 1851, but for the first few years logging operations were confined entirely to pine, spruce and fir. The redwood was an unknown tree to the lumbermen from the East, who were among the pioneers of the county. Later on, however, when the qualities and value of the redwood began to be recognized, the little pony mills, originally built on the bay, gave place to those better equipped to manufacture the mammoth logs into lumber, and in a short time the cutting of pine had practically ceased. Logging operations, also, of necessity, underwent changes, and these changes are still going on; steam power being introduced wherever possible. The first steam railroad ever built in California was that in use for bringing logs and lumber from the woods and mills back of Arcata. It was a tramway, about six miles long, with laurel wood rails, over which the cars were drawn by a steam dummy, and was constructed in the early '50's. From this small beginning the county now has over one hundred miles of thoroughly equipped railroads, which have been built and are used by the various lumbering companies for transporting their logs from the



SCOTIA MILL

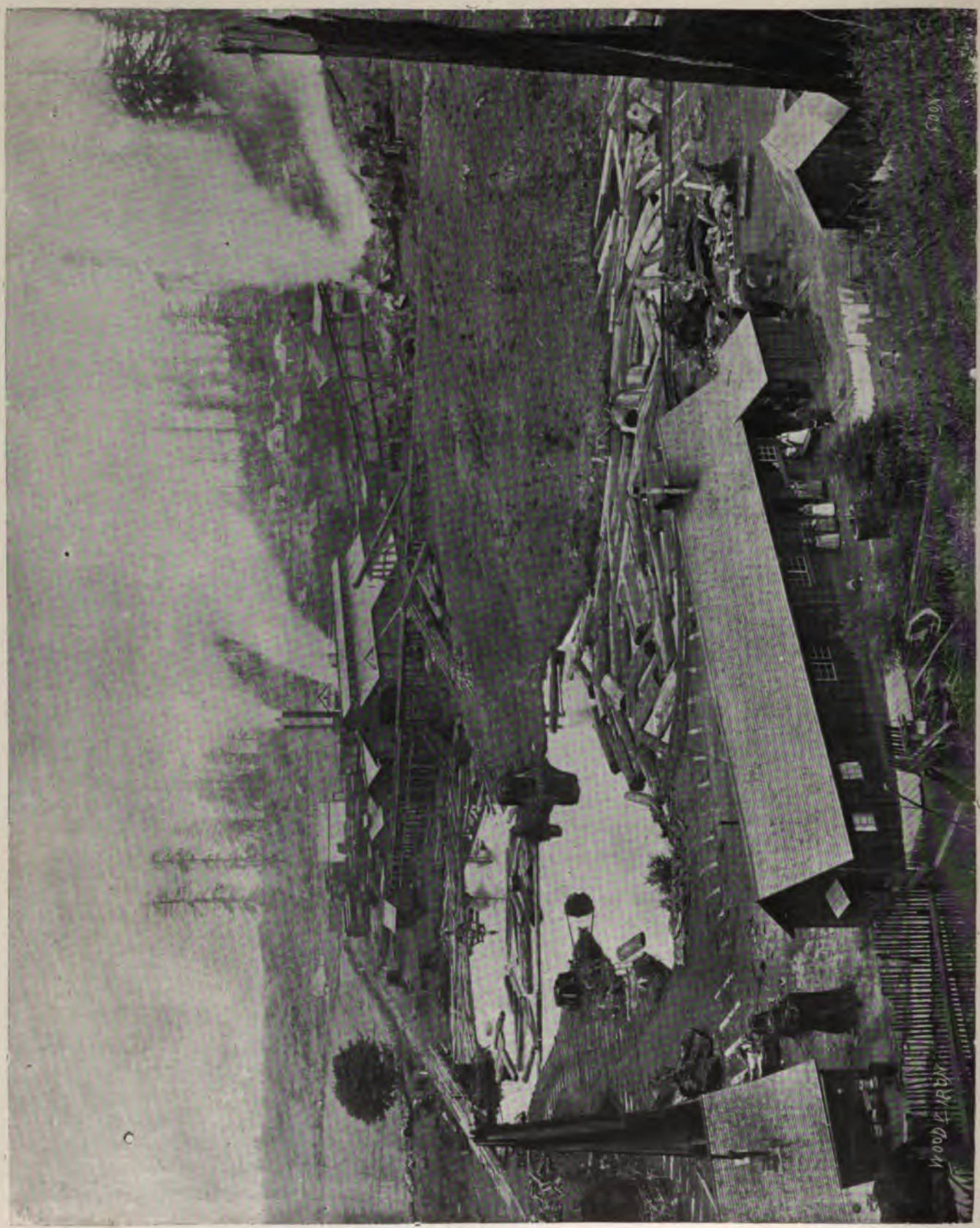
woods to the mills, and the lumber from the interior mills to the shipping point on Humboldt bay.

To manufacture her redwood into lumber Humboldt has twenty-six saw mills, but of these only twelve are now running steadily. They are, however, among the largest in the state, of modern equipment, and keeping abreast of the times in this age of invention. Besides the lumber mills there are twenty-five mills manufacturing redwood shingles and shakes, a number of small saw mills for local trade in the interior of the county, and four sash and door factories and moulding mills.

MILFORD LAND AND LUMBER CO'S. MILL—*See Page 47.*

The exports of redwood lumber from Humboldt county, in which are included all manufactures of redwood, average about 150,000,000 feet, B. M., annually, all of which is shipped out by water. With the exception of a few million shingles from Trinidad, an open port eighteen miles north of Humboldt Bay, and a few hundred cords of bolts from Eel river, which is navigable for a few miles during the summer months, all of this lumber is loaded on vessels in Humboldt Bay. Between five and six hundred cargoes are annually taken out of this bay on steam and sailing vessels, many of which are bound direct for the islands of the Pacific, Australia and even China. Humboldt is justly proud of her fine harbor, the commercial importance of which has been recognized by the general government with an appropriation of $1,715,115 for its improvement, and the placing of the work in the continuous contract system. The work includes the building of jetties seaward to deepen the channel of the bar at the entrance, which work is now well under way, with marked improvement of the conditions already noticeable.

Comparatively little pine, or timber other than redwood, is now cut in the county, and scarcely any shipped. Humboldt has some magnificent tracts of pine especially valuable for ship timber, and what pine is cut is used principally for that purpose. Shipbuilding is one of the leading industries of the county, the ship yards of Humboldt Bay having turned out many fine vessels. A large percentage of the sailing vessels engaged in the coasting and island trade, and several steamers, are built of Humboldt pine, and first entered the water from the shore of Humboldt Bay. The four-masted barkentine, Jane L. Stanford, the largest wooden sailing vessel ever built in California, was launched on Humboldt Bay. Tanbark is also one of the Humboldt forest products exported. Also ship knees and California laurel or pepperwood logs.



EEL RIVER VALLEY LUMBER CO.'S MILL.

THE SCOTIA MILL.

The Pacific Lumber Co.'s new mill at Scotia, on Eel river, Humboldt county, is the latest addition to the redwood manufacturing plants of the coast, having been completed only last July, just one year from the date of the burning of the old mill, which it replaced. The new mill is triple, having three band saws, besides a band splitter, a gang saw and two gang edgers. It is the largest mill in the redwood belt, having a capacity of 135,000 feet per day. With all the latest machinery to choose from, and with the relative value of the various inventions demonstrated in other new mills, the Pacific Lumber Co. were enabled to make theirs a complete mill in every department. The company's timber holdings comprise some of the finest redwood in the county. In logging in these woods all of the latest appliances and methods are in use, and into them the company has constructed four miles of railroad from the mill. In the opposite direction this road is extended seven miles to connect with the Eel river and Eureka railroad, over which the finished product is transported to the company's wharf at Field's Landing, on South bay, an arm of Humboldt bay. The company owns a number of vessels, among them being the well-known sailers and carriers, the schooners John A. and Allen A. The San Francisco offices of the company, of which Allen A. Curtis is president, are at No. 6 California street, and the yards are at Sixth and Hooper streets, San Francisco, and at Berkeley. Mr. John A. Sinclair is superintendent and manager of the plant at Scotia, and Mr. Geo. L. Swett is the San Francisco manager.

EEL RIVER VALLEY LUMBER CO.'S MILL.

This is a busy mill at Newberg, about two miles from Fortuna, Humboldt county. It was originally a circular mill, but a band saw has recently displaced the old-fashioned saws, giving an output of 50,000 feet of lumber per day. In conjunction with the mill the company also operates a shingle mill, which is capable of manufacturing 60,000 shingles daily. The log supply is derived from 4000 acres of the thick redwood forest of Eel river valley, and for their logging operations the company have built three miles of railroad. The products of the mill are shipped out over the Eel River & Eureka Railroad to the company's wharf at Field's Landing, on Humboldt bay, a distance of eighteen miles. Messrs. Pollard & Dodge, the principal owners, represent the company in San Francisco, with offices at No. 22 California street.

UNION MILL — *See Page 49.*

THE MILFORD LAND AND LUMBER CO.

The mill of this company is situated on Salmon creek, a tributary of Humboldt bay, draining some exceptionally fine timber land south of Eureka. A considerable portion of this timber is owned by the company, who have placed their mill almost in the midst of it. From these woods the logs are brought out and put into the shallow bed of the stream. When a sufficient quantity has been gathered for a drive, water is turned in from sluice dams along the route, and the logs are floated down to the mill. The mill has a capacity of about 1,000,000 feet per month, and its output is conveyed by rail to the company's wharf at Field's Landing, on Hum-

ELK RIVER MILL.

boldt bay. The company, which was incorporated in 1869, is composed of Wm. Carson, John Dolbeer, Geo. D. Gray and Wm. Snyder, and have offices at No. 3 California street, San Francisco, Messrs. Gray & Mitchell being the agents.

THE ELK RIVER MILL.

This is another of Humboldt's interior mills, and is owned by the Elk River Mill and Lumber Co. It is situated a couple of miles above the mouth of Elk river, a small stream emptying into Humboldt bay, south of Eureka, and has for its source of supply 3000 acres of fine redwood timber, owned by the company, on that stream. The original mill, using double circulars, was destroyed by fire several years ago, and in its place was erected a more modern mill, which was equipped with a band saw of Pacific coast make. The new mill proved a grand success, and has a record of 58,000 feet of merchantable lumber in a ten hours' run. Its daily average is 45,000 feet. The shipping point for the product of the mill is Bucksport, on Humboldt bay, just outside the city limits of Eureka, to which point it is brought over the Bucksport & Elk River Railroad. N. H. Falk is manager of the company, and gives his personal attention to the operations at the mill. The agency in San Francisco is with J. R. Hanify & Co., of 22 Market street.

THE UNION MILL,

Owned by the firm of Flanigan, Brosnan & Co. of Eureka, is one of the three sawmills located within the corporate limits of that city. It is a band sawmill, provided with all the latest devices, and has a capacity of 50,000 feet per day. For its size it is one of the best equipped mills in the county, and, owing to its position on the bay shore, with the main ship channel in front of it, enjoys superior facilities for loading vessels with its output. The company's timber possessions are on Jacoby creek, which empties into Humboldt bay about six miles north-

OCCIDENTAL MILL.

east of Eureka. On this stream, about two or three miles inland, the company have a fine body of redwood, and also operate a shingle mill. One of the best constructed lines of railroad in the county has been built into these woods, and out into the bay over a wharf one and three-quarter miles long to deep water. Over this road the logs are brought out and dumped into the bay, to be rafted to the mill, while the shingles are loaded directly upon vessels at the end of the wharf. Higgins & Collins, of No. 22 Market street, are the San Francisco agents.

THE OCCIDENTAL MILL.

This is the property of McKay & Co., incorporated, and is situated in the City of Eureka, on Humboldt bay. It is the oldest mill in Humboldt county, but keeps

abreast of the times in the matter of machinery. A band re-saw has recently been added, and, with the triple circulars, gives the mill a capacity of 50,000 feet of lumber per day, and good lumber at that. Its auxiliary machinery is all of the latest pattern, and enables it to make excellent finished lumber. The company's timber possessions border on the city limits to the south and east, and logging operations there are carried on by

THE SAMOA MILL,

Owned by the John Vance Mill and Lumber Co., is situated on Humboldt bay, on the peninsula opposite the City of Eureka. It has been in operation only about two years, and can therefore be called a modern mill. It is a single band sawmill, using also a band saw "splitter," and having besides all the latest improved auxiliary machinery, including a gang specially suited to redwood

SAMOA MILL.

means of the latest appliances, including an original type of cable logging engine. In connection with these operations the company owns and operates six miles of railroad for transporting the logs from the woods to an arm of the bay along the eastern boundary of the city, whence they are rafted to the mill. For getting the product to market the company owns a fleet of schooners - the Occidental, Fortuna and Ida McKay, the two first named vessels being engaged constantly between Eureka and San Francisco. J. J. Loggie, with offices at No. 4 California street, San Francisco, is president and general manager of the company.

timber. In the construction of the mill special attention was given to facilities for economically handling the output. By means of an elevated tramway from the mill out on the wharf lumber is taken on push cars directly from the saw to the vessels, into which it is lowered by a traveling crane on the same tramway, and which operates to either side or at the end of the wharf. The logs for the mill are obtained from the company's woods on Mad river and Lindsay creek, from which they are brought twelve or fifteen miles along the company's railroad, one of the most substantial roads on the coast. The Vance timber is among the finest in the redwood belt, owing to

the large percentage of rough clear obtainable, and from this fact the Vance lumber has become justly celebrated. Their lumber is greatly in demand in Australia, to which country they are the principal shippers of redwood from this coast, and have three large vessels of their fleet employed in that trade, besides furnishing cargoes to order for other vessels. E. H. Vance, son of the founder of the business, the late pioneer, John Vance, is president and resident manager of the company, and J. R. Hanify

timber, which, like that of the Vance Company's, is among the finest in the redwood belt, affording a large proportion of rough clear lumber. The logs are brought down on the Vance road to tide water on the north arm of the bay, whence they are rafted to the mill, a distance of six or eight miles. Messrs. Dolbeer & Carson make a specialty of "stuck," or air-dried lumber, and at their mill in Eureka have one of the largest and most unique drying yards on the coast. It is a natural dry yard,

BAY MILL.

& Co., of No. 22 Market street, are the San Francisco agents.

THE BAY MILL.

This mill, owned and operated by Messrs. Dolbeer & Carson, is located in the City of Eureka, on the shore of Humboldt bay. It was rebuilt as a circular mill in 1876, after the fire which destroyed the original mill, but has since been altered to a band sawmill and fitted with all the latest appliances. The firm have two sources of log supply, the one from their woods on Elk river, south of Eureka, and the other adjoining the John Vance Mill and Lumber Co.'s timber on Mad river, north of the city. Since the completion of the Vance Company's railroad to Samoa, the firm have temporarily abandoned work in their Elk river woods and are logging their Mad river and there is piled in it nearly 4,000,000 feet of lumber in various stages of the process. In addition to this they have a stock of about the same amount of green lumber. Mr. Wm. Carson is the resident owner and manager at Eureka, and Mr. John Dolbeer represents the firm in San Francisco, with offices at No. 10 California street.

THE GLENDALE MILL.

This is one of the busiest little mills on the coast, and is situated on Mad river, about three miles above Arcata, in Humboldt county. It is a band sawmill of about 45,000 feet capacity, and is owned by Isaac Minor, who was also owner of the Warren Creek Mill, near by, which was recently destroyed by fire. The mill derives its supply of logs from some fine timber on Mad river, adjoining

GLENDALE MILL.

the Vance's, and its finished product is hauled over the Korbel Bro's. Arcata and Mad River Railroad to the end of the Arcata wharf, a distance of five or six miles. Mr. Minor has developed a large trade with the Hawaiian Islands, and is the heaviest shipper of Island cargoes in Humboldt. Two of his schooners, the Jessie Minor and Bertie Minor, are employed constantly in the trade, while numerous cargoes are furnished each year for foreign and other vessels. J. R. Hanify & Co. of No. 22 Market street are the San Francisco agents, while Mr. Minor gives his personal attention to the business in Humboldt. The company's agency in San Francisco is with Chas. Nelson, at No. 6 California street.

THE NORTH FORK MILL.

This mill derives its name from the stream on which it is situated — the north fork of Mad river. The location is about twelve miles east of Arcata, amid the magnificent forests of the Mad river country, where the thriving little town of Korbel has sprung up. The company operating the plant is the Humboldt Lumber Mil-

RIVERSIDE MILL.

THE RIVERSIDE MILL.

Another of the mills located in the richly timbered Mad river country of Humboldt county is that owned by the Riverside Lumber Co., of which H. W. Jackson of Arcata is president. This mill has a band-saw of 45,000 feet daily capacity, and is built on the bank of Mad river, about a mile from the junction of the North Fork at Korbel. The timber owned by the company is among the finest in that region, and as the logs are got out they are stored in an immense pond. To get the lumber from the mill to the shipping point at Arcata wharf the Arcata and Mad River Railroad Company have built a switch track, and over this road it is hauled to the end of the wharf, a distance of about eleven miles.

ling Co., in which the Korbel Brothers of San Francisco are the principal owners. The mill originally a double circular, has lately been fitted with two band saws and other modern equipments, and is capable of turning out 70,000 feet of lumber per day. A special manufacture of this mill is redwood tank stuff, of which large quantities are shipped to all parts of this State and the East. Logs are brought to the mill and the finished product taken out over the Arcata and Mad River Railroad, owned by Messrs. Korbel Bros., who have extended the road into the woods at one end, and out into deep water on the bay on the other end by means of a wharf nearly three miles long. Chas. Nelson of No. 6 California street is agent for the company in San Francisco.

NORTH FORK MILL.

DEL NORTE COUNTY

THE NORTHERN LIMIT OF THE REDWOOD BELT

DEL NORTE, the northernmost county of California, marks the northern limit of California's exclusive body of timber. Its coast line is a continuation of that of Humboldt county, whose redwood forest continues along it almost to the Oregon State line, which bounds Del Norte on the north. The width of the belt in Del Norte, however, is reduced considerably, thus giving a comparatively small acreage of timber, but what the county lacks in quantity is made up in quality, for some of the finest bodies of redwood to be found on the coast are here. In fact there are many things that go to recompense Del Norte for the small share of forest wealth allotted her. The redwoods are generally large, the growth unusually heavy, with a fair percentage of clear timber, while the forest country is comparatively level.

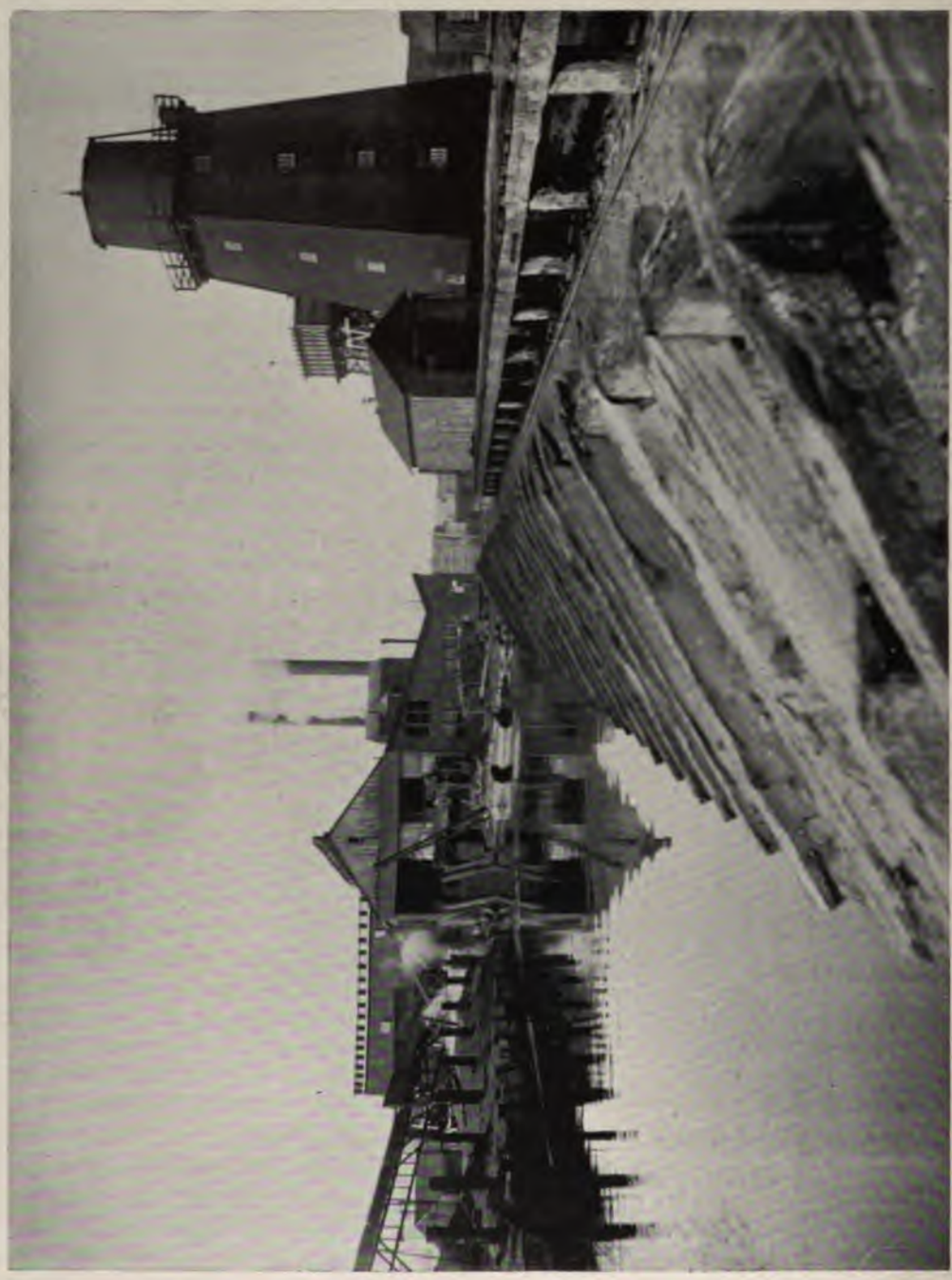
The area of redwood timber still standing in Del Norte is about 67,000 acres of virgin forest, while of an original area of 7800 acres of spruce there still remain about 1800 acres of good timber. It is comparatively recent that Del Norte put forth her claims as a redwood producer, her logging operations having previously been confined to her spruce tracts. Even the shipments of this lumber from the county were not begun until 1869, when the original Lake Earl Mill was built by the Crescent City Mill and Transportation Co. Two years and a half later Messrs. Hobbs, Wall & Co. built their mill at Crescent City, and although there had been previously several small mills sawing for local consumption, these two mills were the first, and are still the only mills sawing for the outside market.

The exports of lumber from these two mills now average about 16,000,000 feet annually, principally redwood, which includes a large amount of rough clear lumber for foreign shipment at San Francisco.

All of this lumber is shipped out of the county by sea from Del Norte's only sea port, Crescent City, the county seat. This town is unique in its location, having been built directly on the sea shore, the surf of Old Pacific actually breaking on its main street during severe storms. The coast here forms a broad bight, with a low sandy beach, down to which the country gently slopes, and at the middle of the crescent-like curve lies Crescent City. Although open, the harbor is comparatively safe at all seasons of the year, and vessels are easily loaded from the chute at the end of the long, high pier built out into the ocean, and owned principally by the two milling companies. Two steamers and several schooners are constantly employed in carrying the output of the mills to San Francisco.

HOBBS, WALL & CO.'S MILL.

Situated at the upper end of Crescent City, and overlooking the broad Pacific, is the fine mill of Hobbs, Wall & Co., built in 1883, and enlarged in 1890. The mill is a triple circular, with a pony saw, designed for cutting either spruce or redwood, and having a capacity of 50,000 feet for the one, or 40,000 feet for the other, daily. It is fitted with a full complement of finishing machinery, and has connected with it a fully equipped box factory. The firm owns over 5000 acres of fine timber, including a quantity of spruce for supplying the raw material for their box factory, and in logging it the latest methods and machinery are employed. The company was one of the first in the redwood belt to discard ox and horse teams in favor of the bull donkey and cable logging road. For getting out this timber the company owns and operates about sixteen miles of railroad connecting Crescent City with the thriving agricultural town of Smith river, on the stream of that name. The line is known as the Crescent City and Smith River Railroad and taps the most fertile region of the section known as Smith River Valley, besides being the key to the vast wealth locked up in her forests. The firm also conducts a large general merchandise store in Crescent City. Their offices in San Francisco are at No. 488 Beale street, corner of Bryant.



HOBBS, WALL & CO.'S MILL.

LAKE EARL MILL.

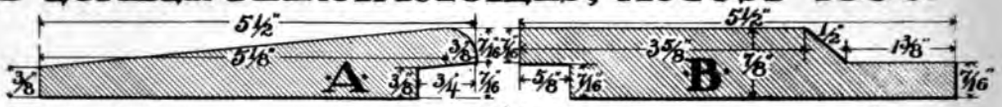
This is the property of the Crescent City Mill and Transportation Co., and takes its name from the fine body of water upon whose shores it is situated, about three miles inland from Crescent City. Here, in 1869, was built the pioneer mill of the county, by Jacob Wenger, Sr., president of the company which owns the present mill. The original mill was destroyed by fire about four years ago, and in its place has been erected a fine single band-sawmill, with a daily capacity of 45,000 feet of lumber. The company's timber possessions of about 2200 acres are all in the immediate vicinity of the lake, which affords excellent storage facilities for logs. The logs are brought there over the Smith River and Crescent City Railroad, which skirts the lake shore, and from which a spur track has been built into the woods for a distance of one and one-half miles. The manufactured lumber is taken away over three miles of the company's own railroad, which delivers it at the end of the ocean pier at Crescent City. The San Francisco agency of the mill is with D. T. C. Perkins, at 48 Market street.

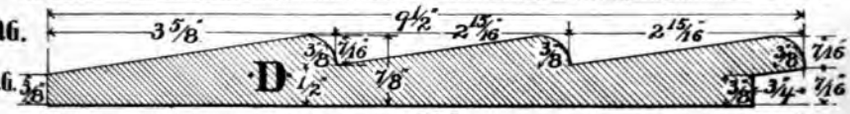
LAKE EARL MILL.

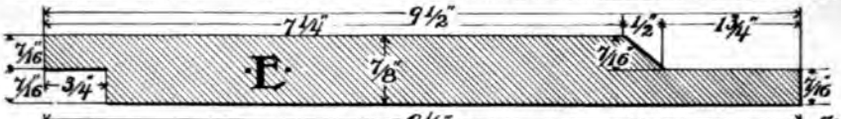
DIMENSIONS OF WORKED REDWOOD LUMBER ADOPTED BY THE REDWOOD LUMBER MANUFACTURERS, AUGUST 1896.

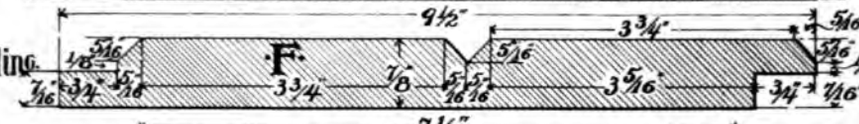
·INDEX·

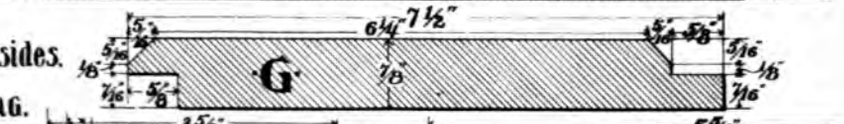
A-1"×6" Drop siding.
B-1"×6" Channel Rustic.
C-1"×10" Two lap drop siding.
D-1"×10" Three lap drop siding.
E-1"×10" Channel Rustic.
F-1"×10" Center V Rustic.
G-1"×8" V Rustic.
H-1"×4" T and G beaded ceiling.
I-1"×6" T and G Flooring.
J-1¼"×4" T and G beaded two sides.
K-1"×6" Center beaded ceiling.
L-¾"×6" T and G beaded.
M-1"×3" O. G. batten.
N-1"×6" Casing S. 4. S.
O-½" Siding.
P-1"×5" Casing S. 4. S.
Q-1"×4" Casing S. 4. S.
R-1"×3" Rough Pointed Pickets.
S-1"×3" Fancy Pickets S. 4. S.

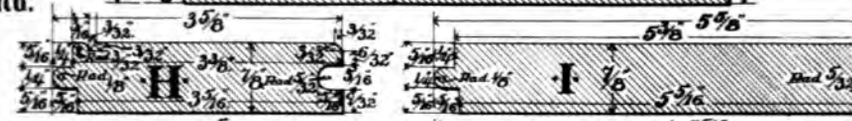


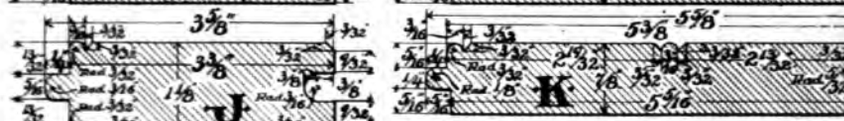


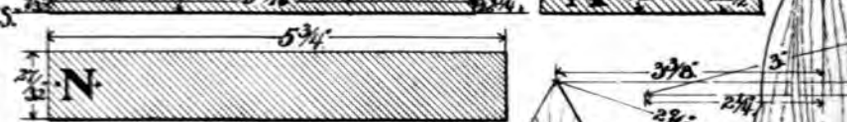


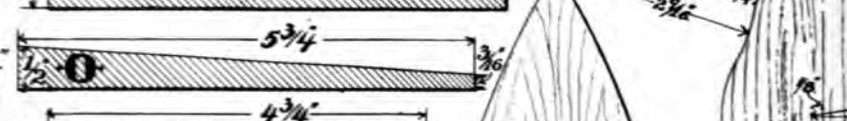


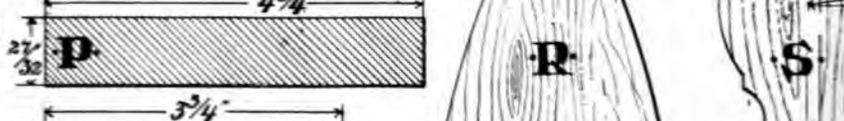


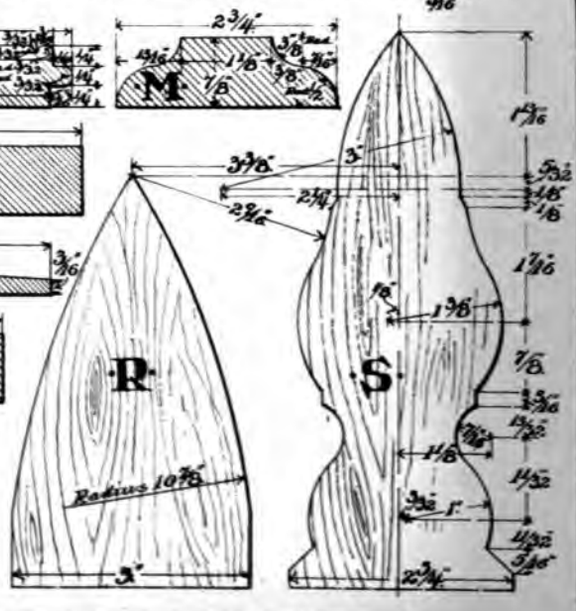












The thickness of 1", 1¼", 1½", 1¾" and 2" surfaced one side shall be 3/32" less than the dimension named.
The thickness of the above, surfaced two sides shall be 5/32" less than the dimension named. ¾" and ½" inch, single or double, surfaced shall be full thickness after working.

RELATIVE TESTS OF REDWOOD AND PINE FOR STREET PAVING BLOCKS.

The following results of tests made at the University of California were received too late to secure proper insertion in the book, and are here presented for reference:

UNIVERSITY OF CALIFORNIA,
CIVIL ENGINEERING LABORATORY,
May 4, 1897.

Report of timber test (*crushing endwise*). Kind of timber, redwood paving blocks (*Sequoia sempervirens*) from Mendocino county, Cal. Air seasoned for two months. Test made for Mr. E. C. Williams of San Francisco, Cal.

Observers { L. E. HUNT, E. N. PROUTY.

No.	DIMENSION HEIGHT INCHES	DIMENSION CROSS SECTIONS INCHES	AREA SQ. IN.	CRUSHING LOAD POUNDS	STRENGTH PER SQ. INCH POUNDS
1	4.00	5.00 x 5.00	25.00	141,480	5659.2
2	"	"	"	134,000	5360.0
3	"	"	"	136,200	5448.0
4	"	"	"	139,780	5591.2
5	"	"	"	134,960	5398.4
6	"	"	"	137,200	5488.0
7	"	"	"	135,660	5426.4
8	"	"	"	137,000	5480.0
9	"	"	"	135,780	5431.2
10	"	"	"	136,540	5461.6
11	"	"	"	131,160	5246.4
12	"	"	"	125,900	5036.0
13	"	"	"	132,680	5307.2
14	"	"	"	125,940	5037.6
15	"	"	"	136,960	5478.4
16	"	"	"	127,140	5085.6
17	"	"	"	126,560	5062.4
18	"	"	"	137,100	5484.0
19	"	"	"	133,860	5354.4
20	"	"	"	136,480	5459.2
21	"	"	"	134,500	5380.0
22	"	"	"	129,800	5192 0
23	"	"	"	133,400	5336.0
24	"	"	"	125,660	5026.4
25	"	"	"	135,640	5425.6
26	"	"	"	137,680	5507.2
27	"	"	"	131,620	5264.8
28	"	"	"	132,180	5287.2
29	"	"	"	129,800	5192 0

Average resistance of redwood block to crushing, 133,463 lbs.
Average resistance of pine block to crushing, - 138,125 "
Average resistance of redwood per square inch - 5,342 "
Average resistance of pine per square inch - - - 5,523 "

UNIVERSITY OF CALIFORNIA,
CIVIL ENGINEERING LABORATORY,
May 4, 1897.

Report of timber test—*crushing endwise*. Kind of timber, Oregon pine paving blocks (*Pseudotsuga Douglasii*) from Puget Sound, Wash. Air seasoned for six months. Test made for Mr. E. C. Williams of San Francisco, Cal.

Observers { L. E HUNT, E. N. PROUTY.

No.	DIMENSION HEIGHT INCHES	DIMENSION CROSS SECTION INCHES	AREA SQ. IN.	CRUSHING LOAD POUNDS	STRENGTH PER SQ. INCH POUNDS
1	4.00	5.00x5.00	25.00	140,640	5625.6
2	"	"	"	151,020	6040.8
3	"	"	"	143,460	5738.4
4	"	"	"	127,060	5082. 1
5	"	"	"	132,140	5285.6
6	"	"	"	130,480	5219.2
7	"	"	"	140,900	5636 0
8	"	"	"	143,180	5727.2
9	"	"	"	138,580	5543.2
10	"	"	"	143,000	5720.0
11	"	"	"	128,840	5153.6
12	"	"	"	137,920	5516.8
13	"	"	"	132,600	5304 0
14	"	"	"	142,060	5682.4
15	"	"	"	140,320	5612.8
16	"	"	"	125,480	5019.2
17	"	"	"	140,640	5625.6
18	"	"	"	136,940	5477.6
19	"	"	"	136,100	5444.0
20	"	"	"	138,120	5524.8
21	"	"	"	140,320	5612.8
22	"	"	"	136,000	5540.0
23	"	"	"	141,180	5647.2
24	"	"	"	136,440	5457.6
25	"	"	"	126,060	5042.4
26	"	"	"	147,920	5916.8
27	"	"	"	143,120	5724.8
28	"	"	"	138,960	5558.4
29	"	"	"	136,100	5444.0
30	"	"	"	142,600	5704.0
31	"	"	"	139,200	5568.0
32	"	"	"	142,800	5712.0

Signed, FRANK SOULE, Prof. Civ. Eng.

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